

Before the
Federal Communications Commission
Washington, D.C. 20554

In the matter of)	
)	
Petition for Waiver of the Part 15 UWB)	ET Docket No. 04-352
Regulations Filed by the Multi-band OFDM)	
Alliance Special Interest Group)	

**PETITION FOR RECONSIDERATION OF
THE SATELLITE INDUSTRY ASSOCIATION**

SATELLITE INDUSTRY ASSOCIATION
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April 11, 2005

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The Satellite Industry Association (“SIA”), pursuant to Section 1.106 of the Commission’s rules, hereby seeks reconsideration of the Order (“Order”) in the above-captioned proceeding.¹

The Satellite Industry Association is a U.S.-based trade association providing worldwide representation of the leading satellite operators, service providers, manufacturers, launch services providers, remote sensing operators, and ground equipment suppliers. SIA is the unified voice of the U.S. satellite industry on policy, regulatory, and legislative issues affecting the satellite business.²

¹*Petition for Waiver of the Part 15 UWB Regulations Filed by the Multi-band OFDM Alliance Special Interest Group*, Order, FCC 05-58 (Mar. 11, 2005).

² SIA includes Executive Members: The Boeing Company; Globalstar LLC; Hughes Network Systems, Inc.; ICO Global Communications; Intelsat; Iridium Satellite LLC; Lockheed Martin Corp.; Loral Space & Communications Ltd.; Mobile Satellite Ventures; Northrop Grumman Corporation; PanAmSat Corporation and SES Americom, Inc. and Associate Members Eutelsat Inc., Inmarsat Ltd., New Skies Satellites Inc., Stratos Global Corporation, and The DirecTV Group.

Introduction and Summary

In its Order, the Commission waived certain emission measurement procedures for ultra-wideband (“UWB”) devices. In particular, it waived the requirement that multiband orthogonal frequency division multiplexing (“MB-OFDM”) UWB devices and direct sequence UWB devices be tested with any frequency hopping, frequency sweeping, step function, and gating features turned off.

The Commission did not dispute that, as shown in a filing made by the Coalition of C-band Constituents, granting this waiver would permit a nearly fourfold increase in the potential for UWB devices to interfere with C-band earth station receivers.³ The Commission found, however, that even with a fourfold increase, interference potential would be within what it considered to be an acceptable range.

The Commission based this finding on test results that had been submitted by the MB-OFDM Alliance Special Interest Group (“MBOA-SIG”). The test results purported to show that, even if MB-OFDM and direct sequence UWB devices were tested with their frequency hopping, frequency sweeping, step function, and gating features turned on, they would have no greater interference potential than the impulse-generated UWB devices that the Commission states in the Order it used as a benchmark when it developed its UWB emissions limits.

SIA seeks reconsideration of the Order. As discussed in this petition, in deciding to grant a waiver the Commission made faulty assumptions and improperly disregarded evidence in the record. In particular:

³ See Order, ¶ 11.

- The Commission believed that its UWB emissions limits are conservative, as a result of which it thought that there was breathing room for additional interference if a waiver were granted. In fact, multiple studies have shown that the existing emissions limits already expose C-band receivers to unacceptable interference.
- The Commission, without explanation, gave no weight to the results submitted by Freescale that directly contradict the test results submitted by MBOA-SIG.
- Although MBOA-SIG's test results were limited to a single type of MB-OFDM device, the Commission waived the testing requirements for all kinds of MB-OFDM devices, and extended the waiver to direct sequence devices, as to which no test results had even been submitted.
- The Commission did not take into account the impact of aggregate interference from interleaved UWB devices. Even if the MBOA-SIG test results were correct, interleaved MB-OFDM devices whose power is measured with the frequency hopping feature turned on will have an interference potential that is 3.6-5.2 dB greater than the interference potential of the impulse-generated UWB waveforms that the Commission stated in the Order it has used as a benchmark.
- The Commission excluded the 5.03-5.65 GHz band from the waiver, based on the fact that NTIA is conducting a measurement program in the band, but included the 3650-4200 MHz C-band downlink band in the waiver, even though NTIA also is conducting a measurement program in that band.

Discussion

I. THE COMMISSION WRONGLY ASSUMED THAT ITS UWB STANDARDS ARE “EXTREMELY CONSERVATIVE” WITH RESPECT TO THE PROTECTION OF FIXED SATELLITE SERVICE EARTH STATION RECEIVERS OPERATING ON C-BAND DOWNLINK FREQUENCIES (3650-3700 MHz AND 3700-4200 MHz)

A fundamental premise of the Commission’s Order is that the UWB emission standards are “extremely conservative” and are “based on modulation and operational characteristics that produced worst case interference results.”⁴ Based on this premise, the Commission believed that interference breathing room would remain even if it granted a waiver permitting UWB devices to be tested with their frequency hop, frequency sweep, stepped frequency modulation, or gating features enabled. In the Commission’s view – a view with which SIA takes issue elsewhere in this petition – UWB devices operating with these features enabled have no greater interference potential than the impulse generated UWB waveforms on which the supposedly conservative current emission standards are based.⁵

The Commission has proceeded from an erroneous premise. Multiple studies have shown that UWB emissions limits must be more stringent than what the Commission has adopted in order to protect fixed satellite service earth station receivers operating on C-band downlink frequencies (*i.e.*, 3650-3700 MHz and 3700-4200 MHz).⁶

Many of these studies were completed after the Commission adopted its UWB emission limits. SIA addressed the studies in detail in its petition for reconsideration⁷ of the Second Report and Order and Second Memorandum

⁴ Order at ¶ 13 and n. 41. See *also* ¶2 (“the Commission implemented standards that it categorized as extremely conservative”).

⁵ See Order, ¶ 12 & n. 39, ¶ 17.

⁶ The studies are discussed below. Citations to the studies are given in that discussion.

⁷ Petition for Reconsideration of the Satellite Industry Association (Mar. 11, 2005)

Opinion and Order (“2nd R&O”) in ET Docket No. 98-153.⁸ The studies demonstrate that, far from being “conservative,” the Commission’s emissions limits expose C-band earth stations to unacceptable interference.

As discussed in SIA’s petition for reconsideration, two steps are required for determining the UWB power limits that are needed to protect C-band FSS downlinks against unacceptable interference:

- (i) quantifying the interference-to-noise (“I/N”) ratio that is needed to protect C-band FSS downlinks, which makes it possible to calculate the required power density after the receive earth station antenna (P_d); and
- (ii) quantifying the EIRP density limit (dBm/MHz) for UWB devices (EIRP_{max}) that will ensure that P_d is not exceeded.

The Commission based its I/N analysis on a value of 0 dB⁹. The vast majority of participants in ITU-R Working Party 4A (“Efficient Orbit Spectrum Utilization”), however, have supported a value of -20 dB for I/N, as expressed in a liaison statement to Task Group 1/8 (Compatibility Between Ultra-Wideband Devices (UWB) and Radiocommunication Services)¹⁰. Similarly, CEPT (European Conference of Telecommunications Administrations) has recently conducted a comprehensive study on this issue, as contained in Report 64 of the Electronic Communications Committee (ECC)¹¹, and has concluded that the protection requirement should be defined by an I/N value of -20 dB¹². With

⁸ *Revision of Part 15 of the Commission’s Rules Regarding Ultra-Wideband Transmission Systems*, Second Report And Order And Second Memorandum Opinion And Order, FCC 04-285 (Dec. 16, 2004).

⁹ See *Revision of Part 15 of the Commission’s Rules Regarding Ultra-Wideband Transmission Systems*, First Report and Order, FCC 98-153 (Apr. 22, 2002) (“1st R&O”), Paragraph 140 and footnote 213; *Revision of Part 15 of the Commission’s Rules Regarding Ultra-Wideband Transmission Systems*, Memorandum Opinion and Order and Further Notice of Proposed Rule Making, FCC 03-33 (March 12, 2003), Paragraph 127 and footnote 300.

¹⁰ Annex 26 to Document 4A/78 (10 May 2004), Liaison Statement to Task Group 1/8, “Interference Caused by Ultra Wide-Band Devices Into the Fixed-Satellite Service below 30 GHz”.

¹¹ ECC Report 64, “*The Protection Requirements of Radiocommunications Systems Below 10.6 GHz from Generic UWB Applications*”, Helsinki, February 2005. A link to Report 64 can be found at <http://www.ero.dk/documentation/docs/doccategory.asp?catid=4&catname=ECC/ERC/ECTRA%20Reports>.

¹² See, for instance, item 11 of the Table included in Section 8 (Overall Conclusions of the Report) or Section A11.2.3 of Annex 11 (Fixed satellite Service – FSS)

respect to I/N, therefore, these studies show that the Commission is off the mark by 20 dB.

The Commission fares no better when it comes to EIRP_{max}. Rather, various studies within and outside the ITU establish that, to provide adequate protection to C-band downlinks, the – 41.3 dBm/MHz EIRP_{max} limit adopted by the Commission for UWB devices might have to be reduced by 30 dB or more.¹³

In short, there was no basis for the Commission's assumption that granting a waiver would be consistent with a conservative approach. The Commission should re-examine its action to take this failing into account.

II. THE COMMISSION DID NOT GIVE A “SATISFACTORY EXPLANATION” FOR FAVORING ONE SET OF RESULTS OVER ANOTHER

The Commission has an obligation to “examine the relevant data and articulate a satisfactory explanation for its action including a rational connection between the facts found and the choice made.”¹⁴ For this purpose, “conclusory explanations for matters involving a central factual dispute where there is considerable evidence in conflict do not suffice.”¹⁵ The Commission's Order falls short of these standards.

There was a “central factual dispute” in this proceeding. Conflicting technical information was submitted concerning which of two kinds of UWB waveforms has a greater potential for causing interference: MB-OFDM waveforms¹⁶ and impulse-generated UWB waveforms. MBOA-SIG submitted test results showing that the type of MB-OFDM waveform known as “MB-OFDM

¹³ See, for instance, Document 1-8/152 (2 June 2004), “FSS/Ultra Wideband Compatibility – Aggregate Interference Studies in the Space-to-Earth Direction” (submission from United Kingdom) and Attachment 3 to Annex 5 to Document 1-8/256 (17 December 04), Working Document Toward a Preliminary Draft New Report, “Studies on Impact of Systems Using UWB Technology on Systems Operating Within the Fixed-satellite Service”, see in particular Table 6.

¹⁴ *AT&T Wireless Services, Inc. v. FCC*, 270 F.3d 59, 968 (DC Cir. 2001) (citation and internal quotation marks omitted).

¹⁵ *Id.* at 968.

¹⁶ Given that the focus was on interference potential if a waiver were granted, the technical information in the case of MB-OFDM waveforms concentrated on waveforms meeting the maximum average EIRP requirement when the frequency hopping feature is in an active mode.

F1F2F3” is less interfering than an “Impulse 3 MHz PRF” by an amount that varies between 0.8 dB and 2.4 dB, depending of the relative level of the noise with respect to the desired signal.¹⁷ Freescale Semiconductor, Inc. (“Freescale”), on the other hand, submitted results that pointed in the opposite direction. Freescale found that an “impulse-generated UWB waveform” is significantly less interfering than “MB-OFDM F1F2F3”.¹⁸

The Commission resolved this central factual dispute by giving credence to MBOA-SIG’s findings and rejecting Freescale’s findings. MBOA-SIG’s findings provide the principle rationale for the Commission’s decision to grant a waiver.¹⁹ The Commission did not, however, give a “satisfactory explanation” as to why it made the choice between MBOA-SIG and Freescale that it did. In fact, it gave no explanation whatsoever.

The only discussion in the Order concerning Freescale’s study, and it is in a footnote, is a passage questioning whether the background noise level employed by Freescale is comparable to real world conditions.²⁰ That passage, however, is irrelevant to the issue of whether MB-OFDM waveforms or impulse-generated waveforms have greater interference potential. Relative UWB interference potential will remain constant across different levels of background noise.

There is good reason, moreover, for believing that MB-OFDM waveforms have greater interference potential than impulse-generated devices. What matters most for interference purposes is the number of symbols affected. An impulse generated waveform will affect – albeit severely – only a small number of symbols (most likely one symbol). A frequency hopping waveform such as MB-OFDM, by way of contrast, will affect a limited but significant number of symbols.

¹⁷ *Petition for Waiver of the Part 15 UWB Regulations Filed by the Multi-band OFDM Alliance Special Interest Group*, Aug. 26, 2004, see slide 12 in document referred to in footnote 22, also submitted as Attachment B.

¹⁸ *Opposition of Freescale Semiconductor, Inc.* (Sep. 29, 2004), see section 3.1 and in particular Figure 4.

¹⁹ See Order, ¶ 12 (“[t]hese [MBOA-SIG] simulations and tests address the interference concerns expressed by Cingular Wireless, the Coalition of C-Band Constituents and other commenting parties”).

²⁰ *Petition for Waiver of the Part 15 UWB Regulations Filed by the Multi-band OFDM Alliance Special Interest Group*, Order, FCC 05-58 (Mar. 11, 2005), see footnote 40.

In sum, the Commission did not articulate a satisfactory explanation for its resolution of a central factual dispute. It chose one set of technical findings over another, but provided no rationale for doing so.²¹

III. THE WAIVER THAT THE COMMISSION GRANTED FOR MB-OFDM DEVICES WAS OVERBROAD

The waiver granted in the Order applies to all MB-OFDM UWB devices. The MBOA-SIG technical analysis on which the Commission relied in granting this waiver, however, is limited to the “MB-OFDM F1F2F3” format.²² The only technical analysis in the record addressing other MB-OFDM formats, which was filed by Freescale,²³ demonstrates that several of these other formats are more interfering than the “MB-OFDM F1F2F3” format, some by more than 5 dB. Similarly, there was no technical analysis in the record addressing any direct sequence formats. Accordingly, in addition to granting a waiver for the MB-OFDM F1F2F3 format on grounds that are shown in this petition to have been erroneous, the Commission extended this waiver to other MB-OFDM formats and to direct sequence UWB with no basis in the record.

IV. THE COMMISSION DID NOT TAKE AGGREGATE INTERFERENCE INTO ACCOUNT

Freescale demonstrated in its Opposition in this proceeding that granting the waiver MBOA-SIG had requested would have an impact on interference potential that would not be observable when a single UWB device is tested. In

²¹ SIA also questions the Commission’s assumption (see Order at ¶12 and n. 39) that impulse-generated UWB waveforms are the benchmark against which other waveforms should be measured. A waiver that generates a nearly fourfold increase (see Order, ¶ 11) in the interference potential of the direct sequence and MB-OFDM waveforms that are going to market is far more significant than whether, following the nearly fourfold increase, the direct sequence and MB-OFDM waveforms will have comparable interference potential to hypothetical impulse-generated UWB waveforms that no one is manufacturing.

²² See *Petition for Waiver of the Part 15 UWB Regulations Filed by the Multi-band OFDM Alliance Special Interest Group, Opposition of Freescale Semiconductor, Inc. (Sep. 29, 2004), Section F4 (Missing test results) on page 14.*

²³ *Opposition of Freescale Semiconductor, Inc. (Sep. 29, 2004), see page 16 of the Technical Analysis submitted with the Opposition and in particular Table 4 in the Technical Analysis.*

particular, Freescale showed that it was possible to interleave in time the transmissions from multiple frequency hopping MB-OFDM devices operating in the same general vicinity so that the devices could reuse the same frequency.²⁴ Collectively, these devices would function as a system that is transmitting continuously.²⁵ Interleaving also can be used in direct sequence UWB devices such as Freescale's that feature gating.

Applying the test procedures that the Commission adopted in the Order to individual MB-OFDM and gated direct sequence UWB devices that use interleaving will produce interference assessments that are inaccurate. Under these procedures, frequency hopping and gating functions will be left on, and the silent periods between transmissions, when no RF energy is produced within the same frequency channel, will be averaged into the readings. From the perspective of a C-band receive earth station, however, there will be no silent periods, because multiple interleaved UWB devices will collectively produce a continuous transmission.

That is true even if the analysis is limited to UWB devices that are near the main beam of a C-band receiver,²⁶ because the UWB devices in an interleaved system (e.g., devices used as part of a local area network in an office building) will be in close proximity to one another. So if one interleaved UWB device is near the main beam of a C-band receiver, the other interleaved devices will be near the main beam as well.

²⁴ *Opposition of Freescale Semiconductor, Inc. (Sep. 29, 2004), see pages 17 through 21 of the Technical Analysis submitted with the Opposition and in particular Figure 8 in the Technical Analysis.*

²⁵ In its reply to Freescale, MBOA-SIG stated that, at present, the UWB devices manufactured by its members do not include interleaving capability. *MBOA-SIG Reply to Oppositions (Oct. 21, 2004), see section IV, p. 14.* MBOA-SIG, however, took no issue with the proposition that interleaving is possible.

²⁶ *See Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems, Second Report And Order And Second Memorandum Opinion And Order, FCC 04-285 (Dec. 16, 2004), ¶¶99* ("The Commission also found that the large majority of the interference potential is caused by the UWB device that is near the main beam of the FSS receiving station. The aggregate contribution from the remainder of the assumed UWB devices is negligible."). SIA is of the view that the aggregate contribution from the remainder is significant in most cases but is using the assumption previously stated by the Commission merely to prove the point being made in this paragraph.

The potential interfering effects of interleaving are substantial. For example, Freescale showed that in the case of the MB-OFDM F1F2F3 waveform, which is silent 75 percent of the time within the frequency channel under consideration, an interleaved system will produce aggregate interference that is nearly four times as much (*i.e.*, 6 dB higher) than will be measured by testing a single interleaved device.²⁷ The impact would be similar for gated direct sequence devices such as Freescale's, which also are silent approximately 75 percent of the time.

Interleaving can push the interference potential of MB-OFDM and gated direct sequence UWB devices to levels well above what the Commission has determined to be acceptable. For example, the MBOA-SIG test results on which the Commission relied showed that, if power is measured when the hopping feature is enabled, an individual MB-OFDM F1F2F3 waveform is less interfering than an Impulse 3 MHz PRF by an amount that varies between 0.8 dB and 2.4 dB.²⁸ As discussed above, however, interleaving MB-OFDM F1F2F3 devices will increase their aggregate interference potential by a figure on the order of 6 dB. Consequently, interleaved MB-OFDM F1F2F3 devices whose power is measured when the hopping feature is enabled will have an interference potential that is 3.6-5.2 dB greater than the interference potential of the impulse-generated UWB waveforms that the Commission has used as a benchmark.²⁹

The Commission did not take into account in its Order the potential for aggregate interference from interleaved UWB devices. Accordingly, the

²⁷ *Opposition of Freescale Semiconductor, Inc. (Sep. 29, 2004), see pages 17 through 21 of the Technical Analysis submitted with the Opposition and in particular Figure 8 in the Technical Analysis.*

²⁸ *Petition for Waiver of the Part 15 UWB Regulations Filed by the Multi-band OFDM Alliance Special Interest Group, Aug. 26, 2004, see slide 12 in document referred to in footnote 22, also submitted as Attachment B.*

²⁹ See Order at ¶12 and n. 39. For reasons that are discussed in Section II above, SIA disagrees with the Commission's use of this benchmark and further notes that, in the presence of conflicting technical information on the relative interference potential of impulse waveforms, the Commission chose one set of technical arguments without articulating an explanation. The Commission, moreover, has acknowledged that the interference analyses involving impulse-generated waveforms on which its UWB emissions limits are based were performed on the assumption that there was no sweeping, hopping, stepping, or gating. See Order, ¶10. Accordingly, even if it were possible to interleave impulse-generated UWB devices, the Commission's earlier analyses did not account for the impact of interleaving.

interference assessment on which the Commission relied was faulty, and needs to be re-examined on reconsideration.

V. THE COMMISSION'S ACTION WAS PREMATURE

NTIA expressed concerns with respect to two government systems operating in the 5.03-5.65 GHz band, and had asked that any waiver not apply to those bands until NTIA's Institute of Telecommunications Science ("ITS") completes its measurement program in the band.³⁰ The Commission granted NTIA's request, limiting the waiver in this proceeding to UWB systems that operate in the 3.1-5.03 GHz and/or 5.65-10.6 GHz bands.³¹

Although NTIA's request understandably was limited to the government frequencies over which NTIA has licensing responsibility, similar considerations apply to C-band downlink frequencies, because NTIA also is conducting a measurement program to assess the interference threat posed by various UWB formats to C-band digital television receivers.³² If the pendency of NTIA's test warranted delaying action on the waiver with respect to the 5.03-5.65 GHz band, then it also warranted delaying action on the waiver with respect to the 3650-4200 MHz band. Assuming that the waiver is not rescinded based on the other considerations addressed in this petition, therefore, it should at a minimum be revised to exclude the 3650-4200 MHz band pending the outcome of NTIA's measurement program.

³⁰ *Petition for Waiver of the Part 15 UWB Regulations Filed by the Multi-band OFDM Alliance Special Interest Group*, Order, FCC 05-58 (Mar. 11, 2005), see ¶16.

³¹ *Id.*

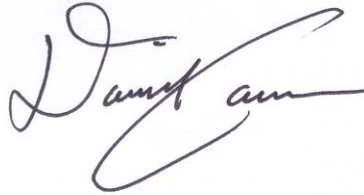
³² Part 1 of the NTIA report on these measurements has been recently published by NTIA. See NTIA Report TR-05-419, "Interference Potential of UWB Signals, Part 1: Procedures to Characterize Ultrawideband Emissions and Measure Interference Susceptibility of C-Band Satellite Digital Television Receivers, Feb. 2005. The published material describes the test setup and procedures but does not include measurement results. These will appear in Part 2 (interference potential for gated Gaussian noise bursts) and Part 3 (interference potential of modern UWB systems).

CONCLUSION

In view of the foregoing, the waiver that the Commission granted in its Order should take the actions suggested in this petition.

Respectfully submitted,

SATELLITE INDUSTRY ASSOCIATION

A handwritten signature in dark ink, appearing to read "David Cavossa", with a stylized, flowing script.

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